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ABSTRACT

The effectiveness of a strategy for remembering words from a word list was investigated in subjects who were high in test anxiety versus subjects who were low in test anxiety. Sixty seventh-grade volunteers from two urban junior high schools were assigned to the strategy training group or the control group. The strategy group was instructed to cluster words into their component categories, while the control group was urged to repeat the words sub-vocally. A free recall paradigm was used. Subjects recalled a list of twelve words from three categories (fruit, clothes, or animals) until one perfect recall was achieved. Subjects were then given a five-minute coding task and were asked to recall as many of the previously learned words as possible. Two measurements of test anxiety assessed state anxiety at both acquisition and at retrieval. The results supported the hypothesis that strategy training improved the performance of highly anxious subjects, compared to the control group. (GDC)

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The Effect of Anxiety and Strategy Training on Learning

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Abstract

This study investigated whether training in a retrieval strategy will be selectively beneficial to students high in test anxiety, compared to low anxious students. Subjects (N=60) were randomly assigned to strategy training or control conditions. A free recall paradigm in which students recalled a list of 12 words consisting of three categories to a criterion of one perfect recall was used. Anxiety was measured at both acquisition and retrieval. The results provide general support for the hypothesis that for high anxious students strategy training resulted in improved performance compared to similar students without this training.

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The Effect of Anxiety and Strategy Training on Learning 1

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The basic purpose of this paper was to test the hypothesis that training in a learning strategy will be selectively beneficial to students high in test anxiety, compared to their low anxiety counterparts. The hypothesis is based on a formulation suggesting that anxiety debilitates learning since its cognitive representation absorbs student cognitive processing capacity (Tobias, 1984,1985). The cognitive capacity highly test anxious students have available for task solution is, then, reduced compared to those less anxious. Students low in anxiety can therefore, devote a greater percentage of their cognitive abilities to task demands, thus resulting in improved performance. It was reasoned that employment of a strategy would reduce the cognitive demands of a task, and hence improve the performance of anxious students compared to a group not taught such a strategy. Little facilitation of performance for less anxious students was expected. Specifically then, an interaction between strategy training and anxiety was expected.

Support for the debilitating effects of anxiety on academic performance has frequently been found. Research has generally concluded that high test anxious students typically perform more poorly on cognitively demanding tasks than do less anxious students especially when the performance conditions are evaluative (Sarason, 1980; Wine, 1980). It has been proposed that anxiety as an affective state can have only an indirect effect on learning by impacting on the cognitive processes mediating learning at various stages. This research model (Tobias, 1977,1979) divides instruction into three

information processing components, input, processing, and output. Input, represents the presentation of instructional material to students. Processing, represents all the operations performed by students to encode, organise and store input. Output, represents the performance of students on evaluative measures after instruction.

Paulman and Kennelly (1984) have provided support for the cognitive capacity interpretation of the effects of test anxiety. Using a dual-task paradigm they assigned students to Raven's matrices and backward digit span tasks either sequentially or concurrently. Results indicated that for the Raven's, only test anxiety exerted an effect on outcome. On backward digit span there were significant main effects for both test anxiety and examination skills. High test anxious subjects remembered significantly fewer total digits on concurrent versus separate (consecutive) trials whereas no differences emerged for low test anxious subjects across the two presentation methods. The increased processing load of the concurrent task appeared to have had a particularly negative effect on individuals with high levels of test anxiety. These results are interpreted as indicating that "test anxiety is associated with an impairment in information-processing capacity that is apparently independent of both ability and exam taking skill...Anxiety by itself seems to signal lower cognitive effectiveness when task demands are high" (p.285).

Cubberly and Weinstein (1983) using a paired-associate learning task investigated the performance of high and low test anxious students. Students were taught either an imagery strategy or to form verbal elaborations and their performance was compared to a control group of high and low test anxious students. The performance of both training groups was found to be superior to that of the control group.

Little difference was found among the training groups for low anxious students, however, there were substantial differences between high anxious students in the two cognitive strategy groups. Training high anxious students to use an imagery strategy was found to be more effective than sentence elaboration in facilitating their performance on the task. The results of this study provide further support for the cognitive capacity model of test anxiety. Strategy training appeared to reduce the cognitive demands of the task for high anxious students resulting in improved task performance.

In this study it was decided to investigate whether training students to use a clustering strategy would be beneficial to high anxious students. It was hypothesized that employment of a strategy would reduce the cognitive demands of the task, and hence improve the performance of test anxious students compared to a group not taught such a strategy. Little facilitation of performance for less anxious students was expected.

Method

A free recall paradigm, in which subjects had to recall a list of 12 words consisting of three categories, was used. Words were administered in random order, and subjects were asked to write down all the words they recalled. A fruit category contained the following words: peach, lemon, grape and plum. A clothes category contained the following words: jacket, boot, shirt and sweater. Finally an animals category consisted of these words: fox, kitten, donkey and deer. Words had a mean frequency of occurrence of 28.17 (Thorndike and Lorge, 1944).

Subjects were randomly assigned into a strategy, and a control group. The strategy group was instructed to cluster words into their

component categories while the control group was urged to repeat words sub-vocally. A teaching list, consisting of 6 words grouped into two categories, toys and vegetables, was also employed. For the training group the teaching list was used as an illustration of how to employ the strategy, while controls used the teaching list as examples of the words to follow.

After attaining a criterion of perfect recall subjects were given an intervening coding task. The coding was similar, but not identical, to the digit symbol task in the Weschler Intelligence Scale for Children. Subjects were given 5 minutes to complete the coding task and on completion were asked to recall as many of the words previously learned as possible. Mild stress instructions to all subjects indicated that performance on this task was positively related to success in school and urged students to try as hard as possible.

Subjects (N-60,47 female) were student volunteers from 7th grade classes at two urban junior high schools. Measures used included the Test Anxiety Scale for Children (TASC; Sarason, Davidson, Lighthall, & Waite, 1958), and the Worry-Emotionality Scale (Morris, Davis & Hutchings, 1981) assessed state anxiety at both acquisition and retrieval.

Results

The degree to which students used a clustering strategy was assessed by the modified ratio of repetition (Hubert & Levin, 1976). The means and standard deviations for the basic dependent variables employed in this investigation are depicted in Table 1. Multivariate regression analyses were computed using the SPSS MANOVA routine. The independent variables consisted of treatment (strategy or control), the Test Anxiety score, and their interaction. There were no overall

multivariate effects for the acquisition data, though, some significant univariate results are displayed in Table 2. The findings of significant superiority in the repetition ratio for the strategy group on both the teaching list and the main word list indicated that students learned the strategy during the instruction phase, and used it more frequently than controls during acquisition. Additionally, the strategy group recalled significantly more words per trial suggesting that the strategy facilitated their acquisition of the words.

The significant interaction obtained using average deviation scores, see Figure 1, for number correct per trial indicated that, as expected, the performance of the control group declined with increases in anxiety, while that of the treatment group improved. That is, one standard deviation above the mean on test anxiety, the control group mean number correct per trial was approximately eight words, compared to nine for the strategy group.

Retrieval data are displayed in Table 3. Again, there were no overall multivariate effects, but two significant interactions were obtained, using average deviation scores, for the number of symbols correctly coded, and the total number of symbols coded, see Figures 2 and 3. Both of these interactions indicated that as test anxiety increased the performance of the strategy group was superior to the controls, whereas the opposite effect occurred at low anxiety levels.

Discussion

The results of this study provide general support for the hypothesis. Training subjects in a grouping strategy facilitated the performance of high test anxious students compared to similar students working on the task without strategy training. The finding of significant interactions for the mean number correct at acquisition

was exactly as predicted. This confirms the results of Cubberly and Weinstein (1983) and provides support for the limited capacity formulation. High test anxious students who were taught the strategy performed better on acquisition of the learning task than those anxious students who did not receive the same training. Thus, using the strategy to learn the word list seemed to reduce the demands of this task for high test anxious students, resulting in their superior performance. The finding of only borderline significance on the number of trials taken indicates that the number correct is a better measure of acquisition than is the number of trials taken. The tendency of some students to make one error and therefore require more trials to reach criterion could have resulted in an overall failure to obtain significant results using this variable.

While the acquisition data confirm the limited capacity model, results for the retrieval data did not reach significance. The retrieval results can be explained in three ways. First, stress was induced before students recalled the list. The anxiety invoked by these instructions could have resulted in reduced cognitive capacity and their failure to apply the previously acquired strategy at retrieval. Second, stress was administered to all subjects at retrieval. Further investigation using a design which includes both a stress and no stress condition at both acquisition and retrieval would clarify the impact of anxiety at these points. Finally, in this study subjects were not made aware that the strategy could help them to remember after learning the material. Therefore, subjects may <u>not</u> have used the strategy when they were required to remember the words. Research has found that cueing subjects to use the training strategy at retrieval can improve recall of previously learned information

(Emmerich & Ackerman, 1978). It has also been shown that training students to know how different strategies may help them to remember at a later time facilitates the more general use of appropriate strategies on memory tasks (Lodico, Ghatala, Levin, Pressley & Bell, 1983). Therefore, future research might cue subjects to use a strategy at both acquisition and retrieval.

The finding of significant disordinal interactions for the coding data are difficult to explain. High anxious subjects who were taught the word clustering strategy performed better on the coding task than high anxious controls. Thus, training in the grouping strategy appeared to facilitate their performance on this intervening task. However, low anxious subjects in the training group performed more poorly on this task than low anxious control group subjects. The results for the control group, poorer performance with increases in anxiety, are in accord with the findings of much anxiety research. Why the performance of the group taught a word clustering strategy would have improved with increases in test anxiety remains obscure. It is hoped that further investigation of this phenomenon may provide a more informative explanation for these findings.

In summary, this study provides support for the cognitive capacity model of test anxiety. It was found that training subjects using a cognitive grouping strategy did reduce task demands for high anxious subjects and facilitated their acquisition of a learning task.

Footnotes

1: This paper was presented at the annual meeting of the American Educational Research Association, Chicago, Illinois, March 31-April 4, 1985. Completion of this study was facilitated by a grant from the Control Data Corporation to the second author.

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TABLE 1

MEANS AND STANDARD DEVIATIONS FOR ANXIETY AND STRATEGY TRAINING STUDY, BY GROUPS

VARIABLES	STRATEGY (N=30)		CONTROL (N=30)	
	M	SD	M	SD
ACQUISITION				
NO. OF TRIALS	7.60	4.89	10.30	6.11
MEAN REPETITION RATIO	.68	.22	.56	.16
MEAN NO. CORRECT PER TRIAL	8.94	1.04	8.44	.84
TOTAL TIME	34.07	8.77	35.10	10.22
MEAN REPETITION RATIO/TEACHING LIST	.64	.30	.42	.22
RETRIEVAL				
REPETITION RATIO	.77	.30	.67	.24
NO. CORRECT	11.30	1.18	11.37	.89
NO. CORRECT/CODING	141.77	30.44	145.33	23.02
TOTAL NO./CODING	142.37	30.68	145.67	23.12

N = 47 FEMALES

N = 13 MALES

TABLE 2

MULTIVARIATE AND UNIVARIATE REGRESSION ANALYSES RESULTS FOR ACQUISITION DATA

	WILKS[A]	NO. OF TRIALS	MEAN REPETITION RATIO	MEAN NO. CORRECT PER TRIAL	TOTAL TIME	MEAN REPETITION RATIO TEACHING LIST
T (TREATMENT)	<1**	3.52	5.34*	4.27*	<1	10.27**
TASC	<1	<1	<1	<1	<1	<1
T X TASC	<1	<1	<1	3.91*	<1	1.14

A) APPROXIMATE F FOR WILK'S LAMBDA.

* $P \leq .05$.

** $P \leq .01$.

TABLE 3

MULTIVARIATE AND UNIVARIATE REGRESSION ANALYSES RESULTS FOR RETRIEVAL DATA

	WILKS[A]	REPETITION RATIO	NO. CORRECT	NO. CORRECT CODING	TOTAL NO. CODING
T (TREATMENT)	<1	1.96	<1	<1	<1
TASC	<1	1.10	1.20	<1	<1
T X TASC	<1	<1	<1	6.38**	6.33**

A) APPROXIMATE F FOR WILK'S LAMBDA.

* $P \leq .05$

** $P \leq .01$

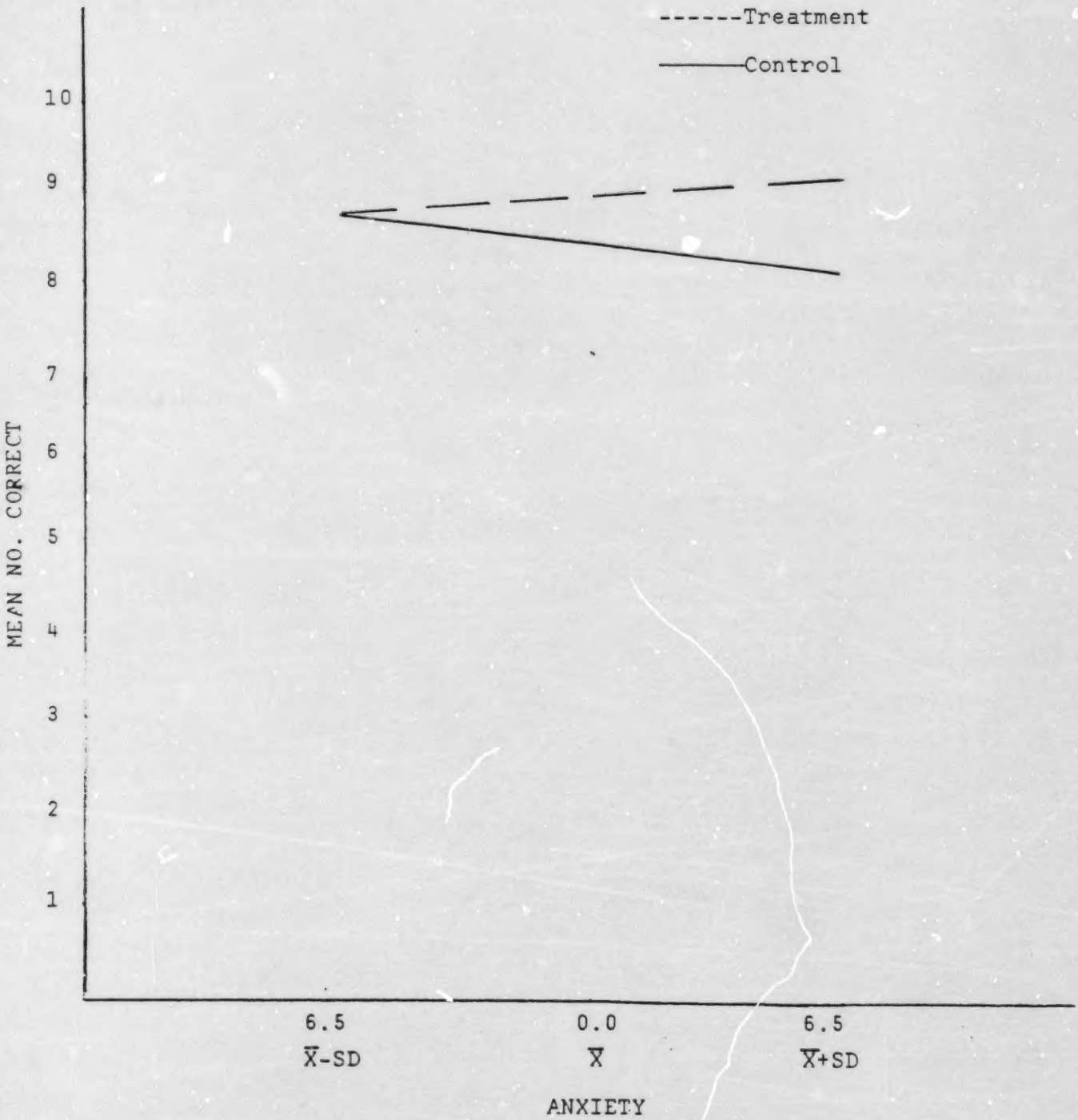

Figure 1: Anxiety by treatment interaction for acquisition of main word list.

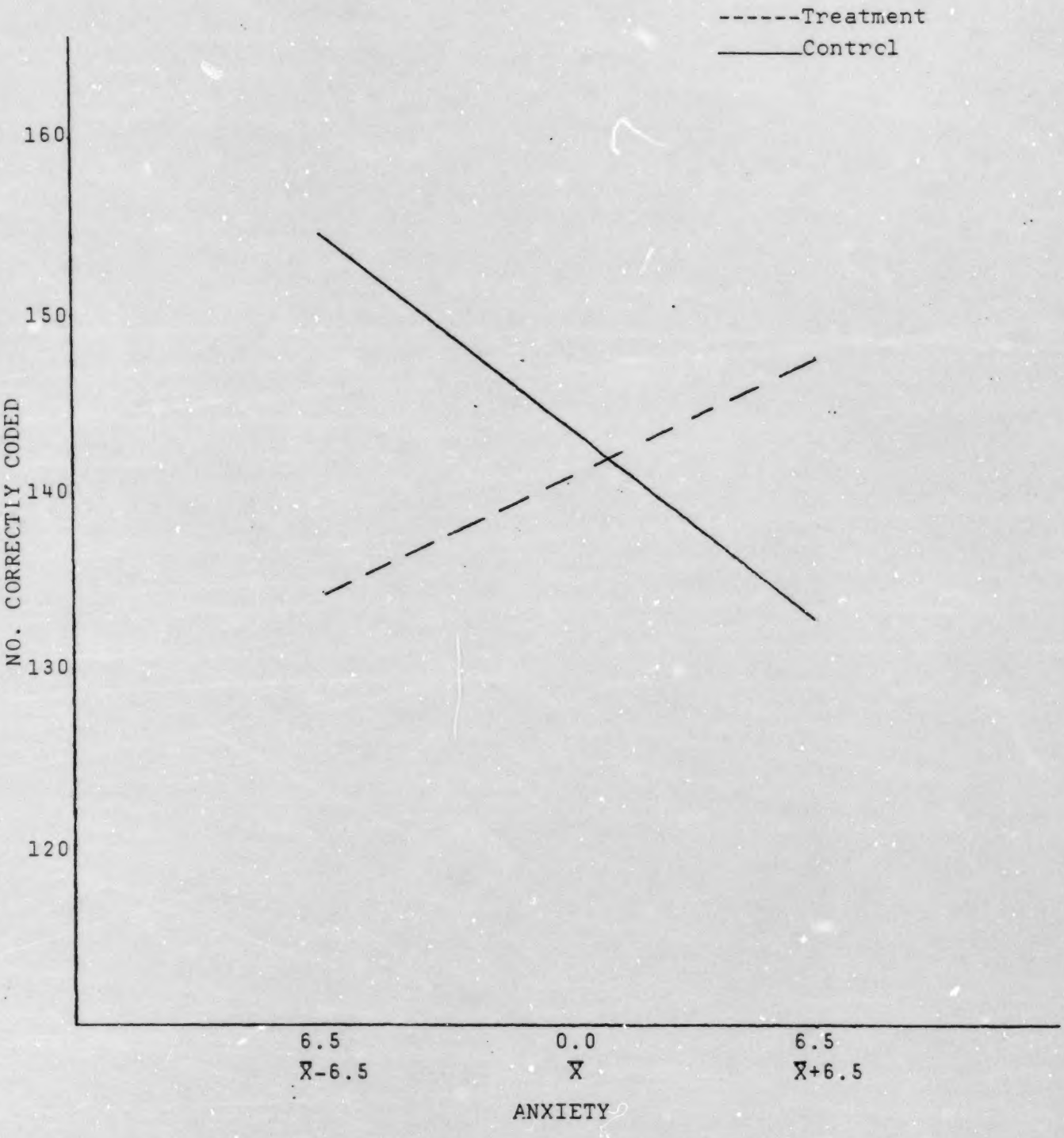

Figure 2: Anxiety by treatment interaction for Coding data.

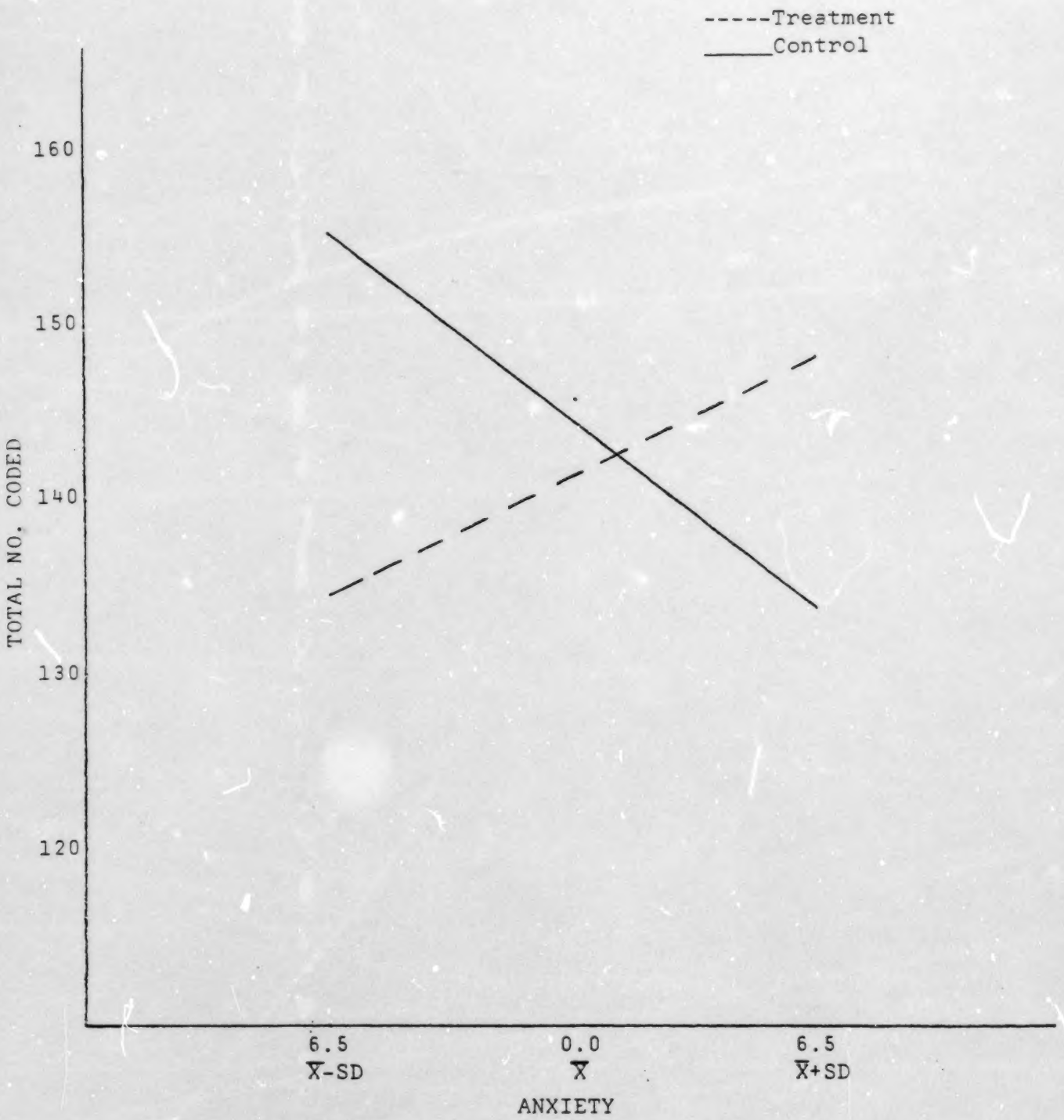

Figure 3: Anxiety by treatment interaction for Coding data.